USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2002WY6B

Title: Real-time monitoring of E.Coli contamination in Wyoming

Project Type: Research

Focus Categories: Water Quality

Keywords: Water Quality Monitoring, Bacteria, Miomonitoring, Bioindicators

Start Date: 03/01/2002

End Date: 02/28/2003

Federal Funds: $17,556

Non-Federal Matching Funds: $72,737

Congressional District: 1

Principal Investigator:
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Abstract

This project will demonstrate the feasibility of economical, real-time detection of individual Escherichia coli in surface water. The Clean Water Act requires states to monitor surface waters for fecal coliforms or specifically for E. coli. Fecal coliform monitoring is an indicator of the sanitary quality of the water and can determine the extent of fecal contamination in the water from warm-blooded animals. Fecal contamination is important from a public standpoint when the surface water's designated use includes contact recreation such as beach use, boating, or swimming. It has recently been shown that E. coli enumeration is more accurate than fecal coliform enumeration in assessing the potential of surface waters to transmit infectious diseases to humans via contact recreation. A low-cost, portable, highly sensitive, self-contained single cell detection system for E. coli enumeration is proposed for rapid monitoring of surface waters, including streams, rivers, and lakes. Funded by Phase I and II NSF STTR grants, the P-I and his team have demonstrated an innovative technique for detection of pathogenic microorganisms, economically and in real time. This technology is based on laser-induced fluorescence of antibody-labeled cells. The proposed project will demonstrate the detection of individual E. coli, after filter removal of background detritus. The suspended bacteria are then stained using an immunofluorescent antibody. The resulting aqueous sample is passed as a stream in front of an LED, which excites the fluorescent labels. The resulting fluorescence is measured with a CCD imager using an innovative integration scheme, giving a dramatically higher signal-to-noise ratio than conventional techniques. The major tasks of this Phase I project will be to 1.) optimize fluorescent labeling of E. coli, 2.) perform laboratory measurements on quantified E coli samples to determine the detection efficiency and sensitivity of the monitoring system, 3.) test methods of filtering out background detritus, 4.) test methods of counting quantified samples of E. coli in a background matrix, 5.) enumerate E. coli in stream and lake water samples using both our proposed method and the standard method currently recommended by the US Environmental Protection Agency. Our goal is a detection limit of £ 5 E. coli cells per 100 ml of sample in less than 15 minutes of analysis time, with a minimum detection efficiency of 80%.

The result of this project will be the development of a prototype low-cost, portable testing system that will allow for water to be monitored in the field continuously and in real time. This system will eventually allow for remote field monitoring with little human intervention.